A STUDY ON SMART HOME INTEGRATION WITH

FPGA CONTROLLER

Pavithra L

Assistant Professor, Department of Electronics and Communication Engineering,
Christ the King Engineering College, Coimbatore, INDIA, pavibhuvi01@gmail.com

Abstract— Nowadays the energy consumption had made a large role in all the industrial as well as in commercial sectors also. At the technologies are also getting developed to reduce the consumption of energy and to conserve it. Our paper deals with the specific task of reducing the consumption of energy in houses and conserving it which can be possible by making the devices automated. Here we are converting the normal devices into smart devices with the help of FPGA controller. Converting normal devices into smart devices will consume the energy only when it's required which directly conserves the energy.

Keywords— FPGA, Sensors, Energy conservation

1. INTRODUCTION

The smart home makes devices smart and it improves the lifestyle. As the devices are turned into smart with the help of FPGA controller and the various sensors. We can easily control and monitor the devices all at a time. In future this can be done wirelessly, so that the devices can be accessed from any part of the world as like IoT. We are using the FPGA controller instead of microcontroller to increase interfacing more number of devices.

2. OBJECTIVE

The main objective of our project is to develop a system which can be easily implemented in the existing system to reduce the energy consumption and to conserve it. So here we are using a FPGA (Field Programmable Gate Array) instead of a microcontroller and several sensors for making the home into smart home.

3. LITERATURE REVIEW

In this project we are using the FPGA controller along with the sensors like Motion sensor, Thermistor, Reed switch and Light Dependent Resistor.

A. Motion sensor

A motion sensor is a device which is used to detect the moving objects, mostly people. Such a device is frequently integrated as a part of a system that automatically performs a task or alerts a user of motion in an area. They form a essential component of safety, automated lighting, home control, energy efficiency and other useful systems.
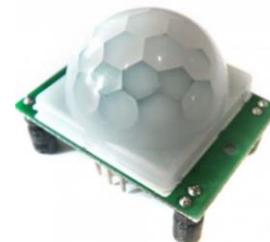

Figure 1 : Motion sensor

The main purpose of motion detection is to sense an burglar and send an alert to your control panel, which alerts your monitoring centre. Sensors work when you are not home, or when you tell the system you are not there. Some security systems can be programmed to record events via a security camera when motion is detected.

Motion sensors stand guard, ready to react to various situations, such as movement in your living room, windows or doors being opened or closed, or a broken window.

B. Thermistor

A thermistor is a type of resistor were the resistance value is depends on the temperature. It functions like when the temperature value increases it losses the resistivity and all the current flow, when the temperature value decreases the resistivity increases and it reduces the current flow value.

Figure 2 : Thermistor

Thermistors are widely used as current limiters and temperature sensors. Thermistors are used as temperature sensors. They can be found in every day appliances such as fire alarms, ovens and refrigerators. They are also used in digital thermometers and in many automotive applications to measure temperature.

C. Reed switch

A reed switch is an electromagnetic switch used to control the flow of electricity in a circuit. They are made from two or more ferrous reeds encased within a small glass tube-like envelope, which become magnetised and move together or separate when a magnetic field is moved towards the switch.

Figure 3 : Reed switch

The reed switch is an electrical switch operated by an applied magnetic field. The switch may be actuated by an electromagnetic coil, making a reed relay, or by bringing a permanent magnet near the switch.

When the magnetic field is removed, the reeds in the reed switch return to their original position. The position of the reeds depends of their construction either back to Normally open contact (NO) or in Normally closed contact (NC)

D. Light dependent resistor

A photo-resistor is a light-controlled variable resistor. The resistance of a photo-resistor decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. A photo-resistor can be applied in light-sensitive detector circuits, and light-activated and dark-activated switching circuits.

Figure 4 : Light dependent resistor

The working principle of an LDR is photo conductivity that is nothing but an optical phenomenon. When the light is absorbed by the material then the conductivity of the material reduces.

When the light falls on the LDR, then the electrons in the valence band of the material are eager to the conduction band.

4. METHODOLOGY

In this project we are using several sensors to achieve the smart operation of the existing devices

This project especially focus on the areas were maximum energy consumption are done like Living room and Kitchen. At the same time it also improves the security level of the house

The combinations of three sensors are done at a single area the sensors used are Thermistor, Motion sensor and the LDR at Kitchen area. Once the motion senor senses any motion of people in the kitchen area it sends the signal to the FPGA controller then the LDR sensor senses the LUX valve and defines whether the light is to be turned ON or not if the LUX value is higher the output of the LDR will be more so there Intensity of light will be more at the room it means that it day time then the Light is not required to turned ON.

If the LUX value of the room is low then the output current vale from the sensor will be less, then it's defined as the time is night time so the Light is required to turn ON.
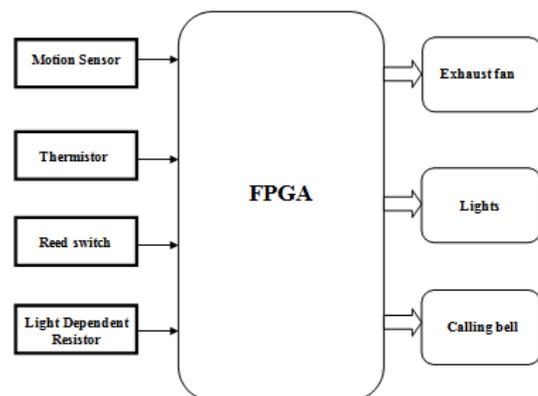

Figure 5 : Block Diagram

The role of thermistor is to control the Exhaust fan in the kitchen once the temperature is raised in the kitchen area than the Atmospheric temperature then the exhaust fan must be turned ON to send the gas out of the kitchen and to maintain the room temperature this will be done only with the signal from motion sensor.

So the combination of motion sensor with the LDR can be applied in all the lighting circuits of the home were as the lights will function smart according to the response signals from the sensors. This will avoid the energy consumption automatically.

The role of reed switch in this project is for security system for the home. The reed switch is connected to the calling bell and the gate the type of reed switch here we have used is NO (Normally open contact) type reed switch were as the magnetic bar is moved from the witch the NO contact becomes NC (Normally closed contact) were the prime contact allows the energy to flow.

In application the concept will be when the gate is closed the circuit will be open if the gate is open the circuit will be closed so if someone opens the gate the Calling bell will rang automatically until the gate is closed.
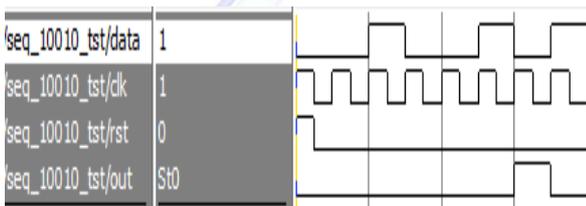
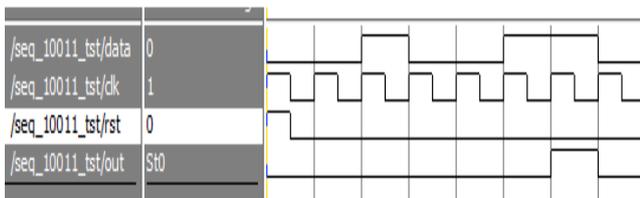## 5. SIMULATION OUTPUTS

Figure 6 : Simulation of Motion sensor
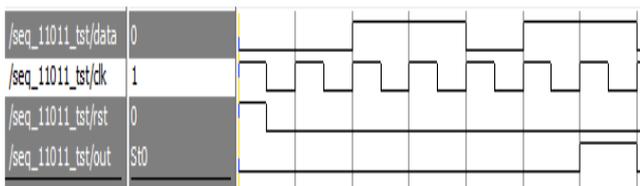

Figure 7 : Simulation of Thermistor

Figure 8 : Simulation of Light Dependent Resistor
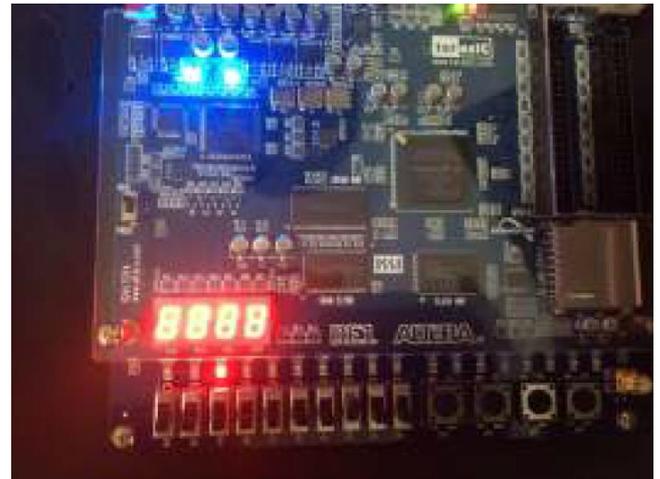
6. HARDWARE IMPLEMENTATION

Figure 9 : Hardware implementation

7. CONCLUSION

In this project we have used only very few sensors control very few electrical items so that we can achieve a little energy conservation if we implement it to the maximum electrical equipments we can achieve more conservation of energy. At the same time the smart devices will help to increase the security systems of the house.

In future these systems can be easily monitored and controlled with the help of IoT concepts.

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